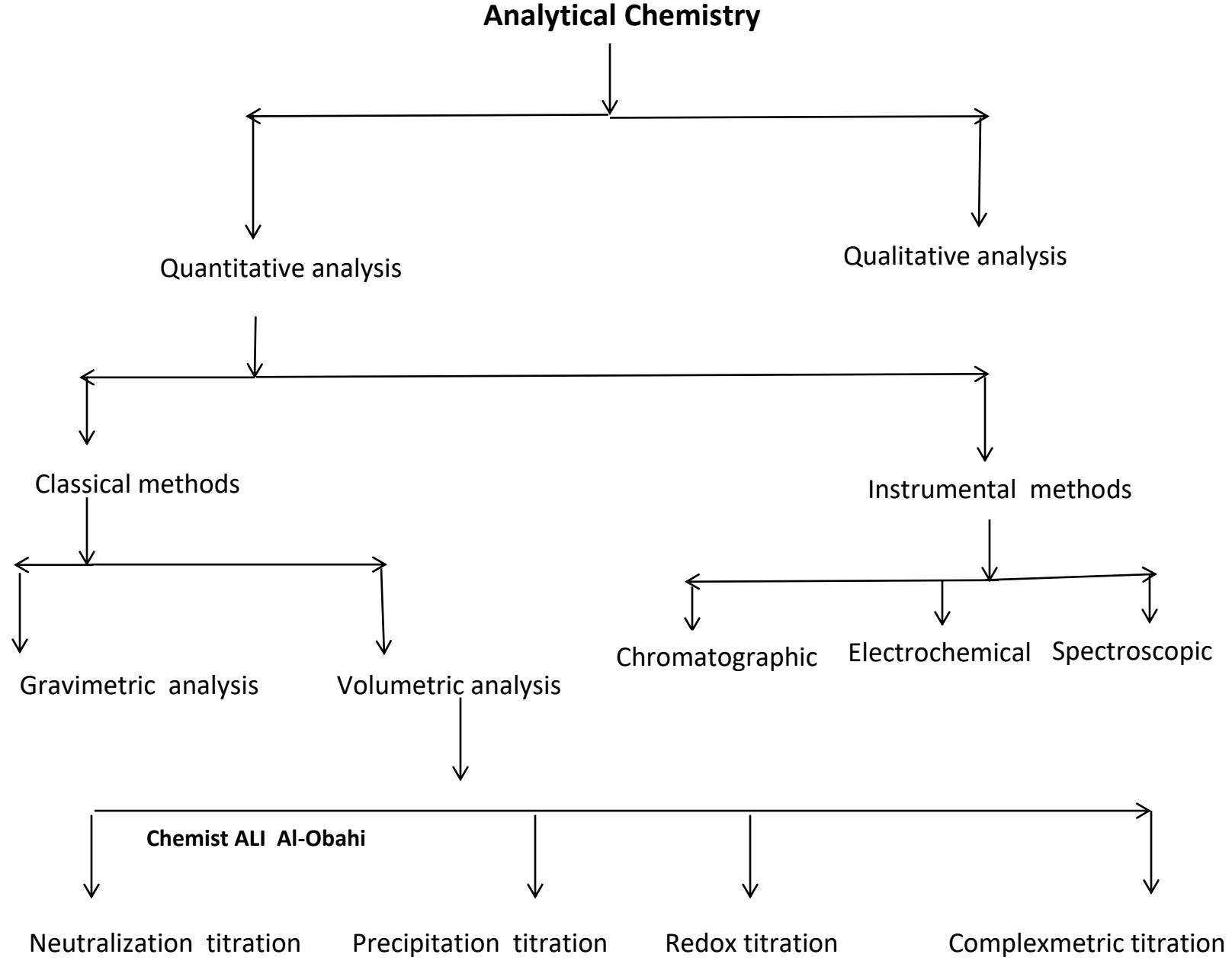
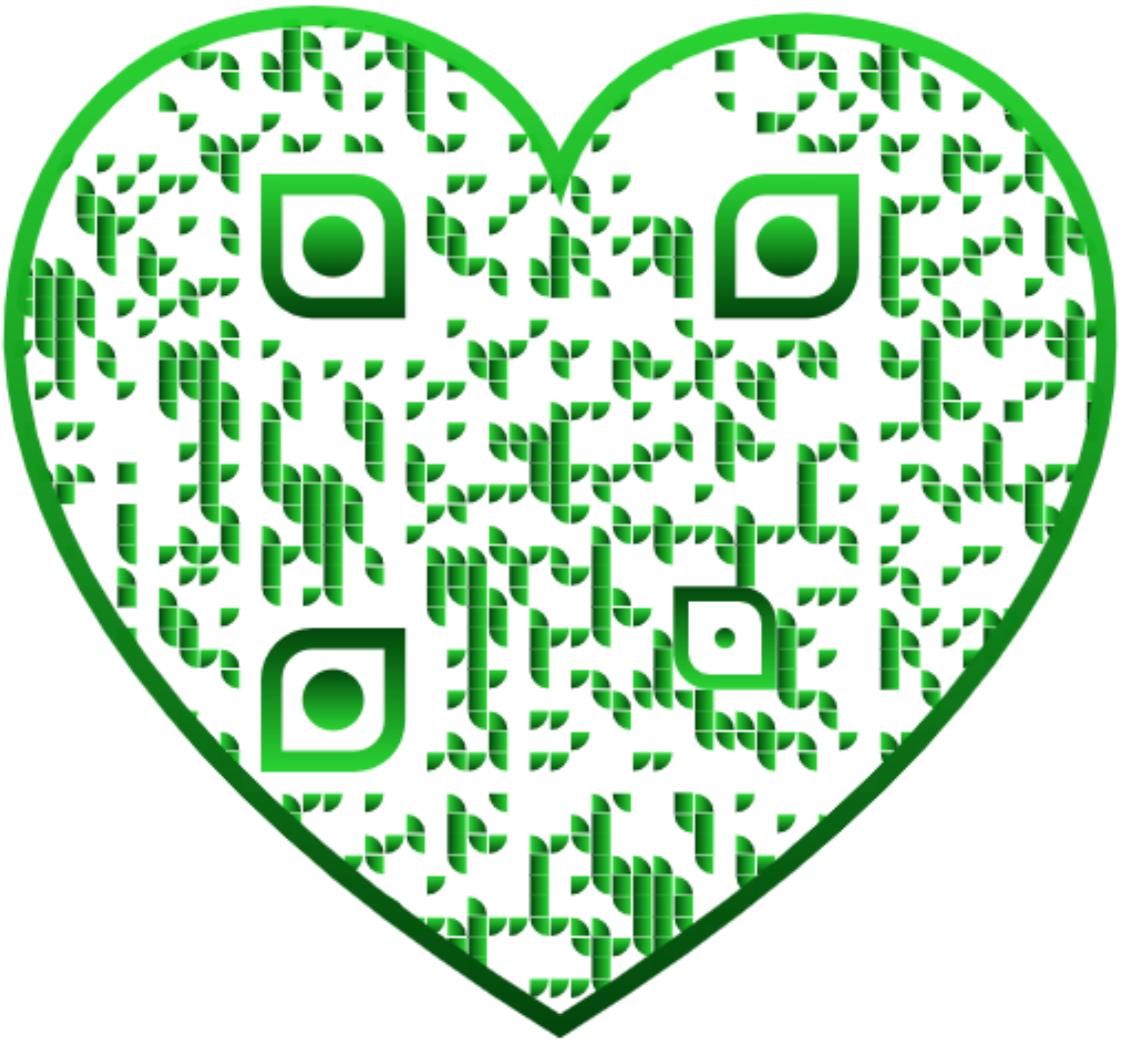
Lab 1

Introduction

Definition of analytical chemistry : It is a branch of chemistry which deals with the study on the identification of materials composition and determination of the amount of each component presented by an expression of concentration directly or indirectly (after separation).

Analytical Chemistry helped in understanding the natural phenomena It develops chemistry science and other sciences since most of the laws based on the quantitative analysis





Neutralization :- it is a Titration reaction between acid and base

- ❖ Titration:- is laboratory technique that measures the concentration of an analyte using reaction between analyte and standard solution (solution of known concentration)

- ❖ Tips for titrations :

- Solution must be shaken well before starting .
- Frist ,a know volume of the analyte is placed in an Erlenmeyer flask ,and a few drops of an acid –base indicator ,such as phenolphthalein (ph.ph) or Methyl Orange (M.O are added .
- Next, the standard solution is placed into a burette this solution is also called as titrant .
- Then, the titrant is added drop by drop to the analyte while swirling the Erlenmeyer flask .
- Titration must be performed slowly and always hold stopcock one hand while swirling the flask with other hand .

- ❖ **The End Point :** it is the practically determined and detected point for completeness of the reaction .

- ❖ **The Equivalent Point :** is the point in a titration when the amount of added standard reagent is exactly equivalent to the amount of analyte .
- ❖ **The indicators :** are chemical substance which added to solution in order to give an observable physical change (changing in color at the end point)

Example:

Indicator	**Acid medium**	**Basic medium**	**Neutral medium**
Ph.ph	Colorless	Pick color	Colorless
M.O	Red	Yellow	Orange

Basic concept

Molecular Weight (M.Wt):-

Is the sum of the atomic mass in the molecules .

EX: HCl , NaOH , $MgCl_2$, K_2CO_3

Where H=1 ,Mg=24 , Cl=35,5 , Na=23 , O=16 , K=39 , Ca=40 , C=12 , Al= 27, Fe=56 , S= 32 ,Mn =55

- HCl 1+35.5 =36.5 $g.mol^{-1}$
- NaOH 23+16+1= 40 $g.mol^{-1}$
- $MgCl_2$ ..... =..... $g.mol^{-1}$
- K_2CO_3 ..... =..... $g.mol^{-1}$
- Al_2CO_3 ..... =..... $g.mol^{-1}$
- $Ca(OH)_2$ ..... =..... $g.mol^{-1}$

Equivalent Weight (Eq.Wt):-

a) For Acids eq.wt= $\frac{M.Wt}{NO.Of\ Ionized\ Hydrogen\ atom\ (H)}$

EX HCl = eq. wt = $\frac{36.5}{1}$ = 36.5 $g.eq^{-1}$

H_2SO_4 = eq.wt= $\frac{98}{2}$ = 49 $g.eq^{-1}$

H_3Po_4 = eq.wt= $\frac{.....}{3}$ = ... $g.eq^{-1}$

b) For Bases = eq.wt= $\frac{M.Wt}{NO.Of\ Ionized\ Hydroxide\ groups\ (OH)}$

EX NaOH eq.wt = $\frac{40}{1}$ = 40 $g.eq^{-1}$

$Ca(OH)_2$ eq.wt $= \frac{\ldots\ldots\ldots}{\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots$ $g.eq^{-1}$

$Al(OH)_3$ eq.wt $= \frac{\ldots\ldots\ldots\ldots}{\ldots\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots$ $g.eq^{-1}$

c) For Salts eq.wt= $\frac{M.Wt}{NO.oF\ cations\ x\ oxidation\ number\ of\ cations\ )}$

EX. Calculate the equivalent weight for Calcium Chloride and Ferric Sulfate

For $CaCl_2$ eq.wt= $\frac{\ldots\ldots\ldots\ldots}{2*1}$ =55.5 $g.eq^{-1}$

For $Fe_{2(}SO_{4\ )3}$ eq.wt= $\frac{\ldots\ldots\ldots\ldots}{3*2}$ =66.66 $g.eq^{-1}$

d) For Oxidizing and Reducing Agents

I. Eq.wt (oxidizing agent) = $\frac{M.Wt}{NO.OF\ gained\ electrons}$

II. Eq.wt (reducing agent) = $\frac{M.Wt}{NO.OF\ lost\ \ electrons}$

EX. Calculate the equivalent weight for potassium permanganate

$MnO^{-4} + 8H^{+} + 5e^{-} \rightleftharpoons Mn^{+2} + 4H_2O$

eq.wt= $\frac{\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots}{5}$ = 31.6 $g.eq^{-1}$

H.W Calculate the equivalent weight for the following compounds :

$Fe(OH)_3$, Na_2CO_3 ,NH_4OH , CH_3COOH , Na_3PO_4 ,$ZnCl_2$,$Pb(OH)_2$